AMENDMENT

Amendments to the Claims

The below listing of claims replaces all prior versions and listings of claims in this application.

Listing of the Claims

1. (Currently amended) Logical element, for executing logical operation~~functions~~, comprising:

an optical junction;

at least two optical inlets, coupled to said optical junction, for receiving at least two incoming light beams; ~~and~~

at least one optical outlet, coupled to said optical junction, at which at least one outgoing light beam is emitted; and

at least one detector for detecting at least one property of said outgoing light beam received from said at least one optical outlet;

wherein said at least two incoming light beams are superposed at said optical junction, thereby producing said at least one outgoing light beam,

wherein said at least one property of said outgoing light beam depends on the relative phase shift of said at least two incoming light beams, and

wherein said relative phase shift comprises a fraction of a cycle (2π) of any value in the range of 0-2π, said range including 0 and 2π.

2. (Canceled)

3. (Canceled)

4. (Currently amended) The logical element according to claim ~~2~~1, wherein at least one of said at least one detector is an optical detector.

5. (Currently amended) The logical element according to claim 4, wherein said at least one optical detector is positioned to measure the light intensity in at least one specific zone of the interference pattern formed by said outgoing light beam received from said at least one optical outlet,

whereby~~in~~ said ~~measure of the~~ light intensity is a function of ~~proportional to~~ said relative phase shift.

6. (Original) The logical element according to claim 5, wherein said at least one zone comprises a Fresnel Zone.

7. (Original) The logical element according to claim 6, wherein said Fresnel Zone is the central Fresnel Zone.

8. (Original) The logical element according to claim 1, further comprising an electro-optic converter, coupled to at least one of said optical inlets.

9. (Original) The logical element according to claim 8, wherein said electro-optic converter comprises at least one light-emitting diode.

10. (Original) The logical element according to claim 1, further comprising an opto-electric converter, coupled to at least one of said at least one optical outlet.

11. (Canceled)

12. (Original) The logical element according to claim 10, wherein said opto-electric converter comprises at least one photodiode.

13. (Currently amended) The logical element according to claim 1, further comprising a light separator, for separating into components said outgoing light beam~~received from at least one of said at least one optical outlet~~, wherein said components are defined by at least one characteristic.

14. (Currently amended) The logical element according to claim 13, wherein said at least one characteristic is selected from the list consisting of: the wavelength of said outgoing light beam and the polarization of said outgoing light beam.

15. (Currently amended) The logical element according to claim ~~14~~13, wherein said light separator comprises at least one ~~dispersive material~~dispersive prism.

16. (Currently amended) The logical element according to claim ~~14~~13, wherein said light separator comprises:

at least one beam-splitter; and

at least two wavelength filters.

17. (Currently amended) The logical element according to claim ~~14~~13, wherein said light separator comprises at least one birefringent material.

18. (Currently amended) The logical element according to claim ~~14~~13, wherein said light separator comprises:

at least one beam-splitter; and

~~at least~~ two polariz~~ze~~ers.

19. (Currently amended) Optical ~~circuitry~~system, comprising a plurality of optical ~~circuitry~~ logical elements, for executing logical operations, ~~wherein each of said optical circuitry elements comprises at least one optical logical element,~~ each optical logical element of said plurality of optical logical elements ~~at least one optical logical element~~ comprising:

an optical junction;

at least two optical inlets, coupled to said optical junction, for receiving at least two incoming light beams; ~~and~~

at least one optical outlet, coupled to said optical junction, at which at least one outgoing light beam is emitted; and~~.~~

at least one detector for detecting at least one property of outgoing light beam received from said at least one optical outlet;

wherein said at least two incoming light beams are superposed at said optical junction, thereby producing said at least one outgoing light beam,

wherein said at least one property of said outgoing light beam depends on the relative phase shift of said at least two incoming light beams, and

wherein said relative phase shift comprises a fraction of a cycle (2π) of any value in the range of 0-2π, said range including 0 and 2π.

20 – 24. (Canceled)

25. (Currently amended) The optical ~~circuitry~~ system according to claim 19, wherein at least one of said plurality of optical ~~circuitry~~ logical elements further comprises at least one phase shifter.

26. (Currently amended) The optical ~~circuitry~~ system according to claim 25, wherein said at least one phase shifter shifts the phase of light passing there through by one half of a cycle (π).

27. (Currently amended) The optical ~~circuitry~~ system according to claim 25, wherein at least one of said at least one phase shifter is coupled to at least one of said at least one optical outlet.

28. (Currently amended) The optical ~~circuitry~~ system according to claim 25, wherein at least one of said at least one phase shifter is coupled to at least one of said at least two optical inlets.

29. (Currently amended) The optical system~~circuitry~~ according to claim 25, wherein at least one of said at least one phase shifter is coupled to at least one optical outlet of at least one of said ~~at least~~ plurality of ~~one~~ optical logical elements, and further coupled to at least one optical inlet of at least another one of said ~~at least one~~ plurality of optical logical elements.

30. (Currently amended) The optical ~~circuitry~~ system according to claim 19, wherein at least one of said plurality of optical ~~circuitry~~ logical elements comprises at least one optical resistor.

31. (Currently amended) The optical ~~circuitry~~ system according to claim 30, wherein at least one of said at least one optical resistor is coupled to at least one of said at least one optical outlet.

32. (Currently amended) The optical ~~circuitry~~ system according to claim 30, wherein at least one of said at least one optical resistor is coupled to at least one of said at least two optical inlets.

33. (Currently amended) The optical ~~circuitry~~ system according to claim 30, wherein at least one of said at least one optical resistor is coupled to at least one optical outlet of at least one of said ~~at least one~~plurality of optical logical ~~element~~elements, and further coupled to at least one optical inlet of at least another one of said ~~at least one~~ plurality of optical logical ~~element~~elements.

34 – 38. (Canceled)

39. (Currently amended) Method for performing logical ~~functions~~ operations, the method comprising the procedures of

providing ~~using~~ at least one group of light beams, ~~each said at least one group of light beams comprising a plurality of light beams~~, each light beam in a respective group of said at least one group of light beams being defined by at least one property, and all light beams in a respective group of said at least one group of light beams sharinges at least one distinctive characteristic;~~, the method comprising the procedure of~~

superposing said all ~~plurality of~~ light beams in a respective group of said at least one group of light beams in an optical junction, thereby producing at least one superposed light beam sharing said distinctive characteristic; and

detecting said at least one property of said at least one superposed light beam.

40. (Currently amended) The method according to claim 39, wherein said at least one property ~~includes~~ comprises the phase shift.

41. (Currently amended) The method according to claim 39, wherein said at least one property ~~includes~~ comprises the amplitude.

42. (Currently amended) The method according to claim 39, wherein each ~~of said~~ light beams in a respective group of said at least one group ~~plurality~~ of light beams has a respective phase shift and amplitude.

43. (Currently amended) The method according to claim 42, wherein each combination of said ~~phases~~phase shifts and amplitudes defines a predetermined logical value.

44. (Currently amended) The method according to claim 39, wherein said at least one distinctive characteristic is selected from the list consisting of:

a wavelength; and

~~a~~an orthogonal polarization direction.

45. (Canceled)

46. (Currently amended) The method according to claim ~~45~~39, further comprising the procedure of determining a logical value for the detected at least one property of said at least one superposed light beam.

47. (Currently amended) The method according to claim 39, wherein~~further comprising the preliminary~~ said procedure of pro~~du~~vid~~e~~ing at least ~~one of said at least~~ one group of light beams comprises providing said at least one group of light beams from at least one light source.

48. (Currently amended) The method according to claim 39, wherein said~~further comprising the preliminary~~ procedure of pro~~du~~vid~~e~~ing ~~at least one of~~ said at least one group of light beams comprises providing said at least one group of light beams in response to at least one electrical signal.

49. (Original) The method according to claim 48, wherein at least one of said at least one group of light beams is produced from said at least one electrical signal using at least one light emitting diode.

50. (Currently amended) The method according to claim ~~45~~39, further comprising the procedure of producing at least one electrical signal in correlation to the detected at least one property of said at least one superposed light beam.

51. (Original) The method according to claim 50, wherein said at least one electrical signal is produced using at least one photodiode.

52. (Currently amended) The method according to claim 39, wherein said at least one property of said at least one superposed light beam comprises the relative phase shift difference among at least two ~~components of said at least one superposed light beams ,wherein each said at least two components is defined by an internal phase shift.~~ light beams in a respective group of said at least one group of light beams, wherein said relative phase shift comprises a fraction of a cycle (2π) of any value in the range of 0-2π, said range including 0 and 2π.

53. (Canceled)

54. (Canceled)

55. (Currently amended) The method according to claim 39, wherein said at least one property of said at least one superposed light beam is detected ~~by measuring light intensity in at least one predetermined location~~ using at least one optical detector.

56. (Currently amended) The method according to claim 39, wherein said procedure of detecting said at least one property of said at least one superposed light beam comprise~~is~~ detecting~~ed~~ by measuring light intensity in at least one predetermined location.

57. (Original) The method according to claim 56, wherein said at least one predetermined location is a Fresnel Zone.

58. (Original) The method according to claim 57, wherein said Fresnel Zone is the central Fresnel Zone.

59. (Canceled)

60. (Canceled)

61. (Original) The method according to claim 39, further comprising the preliminary procedure of changing the phase shift of at least one light beam of said group of light beams.

62. (Original) The method according to claim 39, further comprising the preliminary procedure of changing the phase shift of at least one of said at least one superposed light beam.

63. (Original) The method according to claim 61, wherein said phase shift of at least one light beam of said group of light beams is changed by one half of a cycle.

64. (Original) The method according to claim 63, wherein said procedure of changing further comprises a sub-procedure of directing at least one of said light beams through at least one phase shifter.

65. (Original) The method according to claim 64, wherein said phase shifter is made of a material having an index of refraction which is different than the index of refraction of a reference material.

66. (Original) The method according to claim 64, wherein said phase shifter is made of a conveying medium, the length of said conveying medium is different than that of a reference conveying medium.

67. (Currently amended) The method according to claim 39, ~~wherein said at least one group of light beams comprises a plurality of groups of light beams, each of said groups yields a plurality of respective superposed light beams, all said respective~~

~~superposed light beams are superposed into a single superposed light beam, the method~~ further comprising the procedure of separating each of said at least one ~~single~~ superposed light beam according to said distinctive characteristic~~into said respective superposed light beams~~.

68. (Currently amended) The method according to claim 67, wherein said at least one ~~property is the wavelength of said light beams~~ distinctive characteristic comprises wavelength; and

wherein said procedure of separating further comprises:

directing said at least one superposed light beam through at least one wavelength filter, wherein said at least one wavelength filter admits only light of a wavelength which is substantially equal to the wavelength of a respective group of said at least one group of light beams.

69. (Currently amended) The method according to claim ~~68~~67, wherein said at least one distinctive characteristic comprises wavelength;~~,~~ and

wherein said procedure of separating further comprises a sub-procedure of directing said at least one ~~of said~~ superposed light beam~~s~~ through at least one ~~dispersive material~~dispersive prism.

70. (Canceled)

71. (Currently amended) The method according to claim 67~~70~~, wherein said at least one distinctive characteristic comprises ~~at least one property is the state of~~ polarization; and

wherein said procedure of separating further comprises:

directing said at least one superposed light beam through at least one polarization filter, wherein said at least one polarization filter admits only light of a polarization which is substantially equal to the polarization of a respective group of said at least one group of light beams ~~of said at least one group of light beams~~.

72. (Currently amended) The method according to claim 67~~71~~, wherein said at least one distinctive characteristic comprises polarization; and

wherein said procedure of separating further comprises ~~a sub-procedure of~~ directing at least one of said superposed light beams through at least one birefringent material.

73. (Currently amended) The method according to claim 67~~68~~, wherein said at least one distinctive characteristic comprises polarization and wavelength~~wherein said procedure of separating further comprises the sub-procedures of:~~

~~splitting said single superposed light beam into a plurality of partial single superposed light beams; and~~

~~directing each said partial single superposed light beams through a respective polarization filter, wherein each of said polarization filters admits only light whose state of~~

~~polarization is substantially equal to the state of polarization of a respective group of said at least one group of light beams~~.

74. (Original) The method according to claim 39, further comprising the procedure of superposing said at least one superposed light beam on at least one additional light beam in at least one additional optical junction.

75. (Original) The method according to claim 74, wherein at least one outlet of said optical junction is optically coupled to at least one inlet of said additional optical junction.

76. (Original) The method according to claim 74, further comprising the procedure of changing the amplitude of said at least one superposed light beam before said procedure of superposing said at least one superposed light beam on said at least one additional light beam.

77. (Original) The method according to claim 76, wherein said procedure of changing further comprises a sub-procedure of reducing said amplitude, by employing at least one optical resistor.

78. (Original) The method according to claim 76, wherein said procedure of changing further comprises a sub-procedure of equalizing said amplitude to the amplitude of said at least one additional light beam, by employing at least one optical resistor.

79. (New) The logical element according to claim 1, wherein said at least one property of said outgoing light beam depends on the amplitudes of said at least two incoming light beams.

80. (New) The logical element according to claim 1, wherein said logical operations comprise Boolean operations.

81. (New) The logical element according to claim 1, wherein said logical operations comprise Non-Boolean operations.

82. (New) The logical element according to claim 1, wherein said logical element is implemented in an optical system.

83. (New) Optical resistor, for emitting an outgoing light beam of an intensity that is lower than the intensity of an incoming light beam, comprising:

an optical junction;

at least one optical inlet, coupled to said optical junction, for receiving at least one incoming light beam; and

at least one optical outlet, coupled to said optical junction, at which at least one outgoing light beam is emitted.

84. (New) The optical resistor according to claim 83, wherein said optical junction comprises a light absorbent material.

85. (New) The optical resistor according to claim 83, wherein said optical junction comprises an optical drainage outlet for channeling away a portion of said incoming light.

86. (New) Optical processor, comprising a plurality of optical logical elements, for executing operations in parallel, each optical logical element of said plurality of optical logical elements comprising:

an optical junction;

at least two optical inlets, coupled to said optical junction, for receiving at least two incoming light beams;

at least one optical outlet, coupled to said optical junction, at which at least one outgoing light beam is emitted; and

at least one detector, for detecting at least one property of said outgoing light beam received from said at least one optical outlet,

wherein said at least two incoming light beams are superposed at said optical junction, thereby producing said at least one outgoing light beam,

wherein said at least one property of said outgoing light beam depends on the relative phase shift of said at least two incoming light beams, and

wherein said relative phase shift comprises a fraction of a cycle (2π) of any value in the range of 0-2π, said range including 0 and 2π.

87. (New) The optical processor according to claim 86, wherein said operations comprise multiple logical operations.

88. (New) The optical processor according to claim 86, wherein said operations comprise switching actions.

89. (New) The optical processor according to claim 86, further comprising a light separator, for separating into components said outgoing light beam, wherein said components are defined by at least one characteristic.

90. (New) The optical processor according to claim 89, wherein said at least one characteristic is selected from the list consisting of: the wavelength of said outgoing light beam and the polarization of said outgoing light beam.

91. (New) The optical processor according to claim 89, wherein said light separator comprises at least one dispersive prism.

92. (New) The optical processor according to claim 89, wherein said light separator comprises:

    at least one beam-splitter; and

    at least two wavelength filters.

93. (New) The optical processor according to claim 89, wherein said light separator comprises at least one birefringent material.

94. (New) The optical processor according to claim 89, wherein said light separator comprises:

    at least one beam-splitter; and

    two polarizers.

95. (New) The optical processor according to claim 89, further comprising at least one respective detector for each separated light component of said outgoing light beam.

96. (New) The optical processor according to claim 86, wherein each of said at least two incoming light beams comprises two orthogonal polarization directions.

97. (New) The optical processor according to claim 96, wherein each of said two orthogonal polarization directions is common to said at least two incoming light beams.

98. (New) The optical processor according to claim 86, wherein each of said at least two incoming light beams comprises at least two wavelengths.

99. (New) The optical processor according to claim 98, wherein each of said at least two wavelengths is common to at least some of said at least two incoming light beams.

100. (New) The method according to claim 39, wherein said logical operations comprise Boolean operations.

101. (New) The method according to claim 39, wherein said logical operations comprise Non-Boolean operations.

102. (New) Optical processor, having a three-dimensional structure, comprising at least two layers and comprising a plurality of optical logical elements, for executing logical operations, each optical logical element of said plurality of optical logical elements comprising:

an optical junction;

at least two optical inlets, coupled to said optical junction, for receiving at least two incoming light beams;

at least one optical outlet, coupled to said optical junction, at which at least one outgoing light beam is emitted; and

at least one detector for detecting at least one property of said outgoing light beam received from said at least one optical outlet,

wherein said at least two incoming light beams are superposed at said optical junction, thereby producing said at least one outgoing light beam,

wherein said at least one property of said outgoing light beam depends on the relative phase shift of said at least two incoming light beams,

wherein said relative phase shift comprises a fraction of a cycle (2π) of any value in the range of 0-2π, said range including 0 and 2π,

wherein at least one optical outlet of at least one of said plurality of optical logical elements is optically coupled to at least one optical inlet of at least another one of said plurality of optical logical elements,

wherein each of said at least two layers comprises at least one of said plurality of optical logical elements; and

wherein at least two of said at least two layers are optically coupled.